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PATENT APPLICATION

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**IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE**

Inventor(s): Peter Mardilovich et al.

Confirmation No.: 5931

Application No.: 10/629,116

Examiner: LEE, Cynthia K.

Filing Date: July 28, 2003

Group Art Unit: 1795

Title: Fuel Cell Support Structure and Method of Manufacture

Mail Stop Appeal Brief - Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF REPLY BRIEF

Transmitted herewith is the Reply Brief with respect to the Examiner's Answer mailed on June 10, 2009 .

This Reply Brief is being filed pursuant to 37 CFR 1.193(b) within two months of the date of the Examiner's Answer.

(Note: Extensions of time are not allowed under 37 CFR 1.136(a))

(Note: Failure to file a Reply Brief will result in dismissal of the Appeal as to the claims made subject to an expressly stated new ground rejection.)

No fee is required for filing of this Reply Brief.

If any fees are required please charge Deposit Account 08-2025.

Respectfully submitted,

Peter Mardilovich et al.

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REPLY BRIEF

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Sir:

This is a Reply Brief under Rule 41.41 (37 C.F.R) in response to the Examiner's Answer of June 10, 2009 (the "Examiner's Answer" or the "Answer"). In Section 10, the Answer contains a response to some of the arguments made in Appellant's brief. Appellant now responds to the Examiner's Answer as follows.

Status of Claims

Claims 1-48 have been cancelled. Claims 49-84 are pending in the application and were finally rejected.

In the Answer, however, the Examiner has indicated that “Claims 53 and 57 are allowable. The remaining claims stand rejected.” (Answer, p. 2).

Appellant also notes, though the Answer did not, that both rejections of claim 51 have been withdrawn. (Answer, p. 3). Consequently, as there remains no rejection of claim 51, claim 51 should have been listed as allowed.

Accordingly, Appellants appeal from the final rejection of claims 49, 50, 52, 54-56 and 58-84, which claims are presented in the Appendix of Appellant’s Brief.

Grounds of Rejection to be Reviewed on Appeal

The final Office Action previously raised the following grounds of rejection:

- (1) Claims 55 and 57 (actually 58) were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite.
- (2) Claims 49, 50, 56, 58, 59, 65 and 66 were rejected as anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 3,503,808 to Agruss (“Agruss”).
- (3) Claims 49, 50-52, 55, 56, 58-61, 64, 70-72, 74, 75, 77-81, 83 and 84 were rejected as anticipated under 35 U.S.C. § 102(b) by U.S. Patent No. 5,234,722 to Ito (“Ito”).
- (4) Claims 58, 60-62, 64 and 67 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,482,792 to Faita (“Faita”).
- (5) Claim 76 was rejected as being unpatentable under 35 U.S.C. § 103(a) over the teachings of Ito in view of Hibino (of record).
- (6) Claim 73 was rejected as being unpatentable under 35 U.S.C. § 103(a) over the teachings of Ito in view of U.S. Patent No. 6,558,831 to Doshi (“Doshi”).
- (7) Claim 82 was rejected as being unpatentable under 35 U.S.C. § 103(a) over the teachings of Ito in view of Doshi.
- (8) Claims 49, 51-53, 55 and 57 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Faita and U.S. Patent No. 6,051,331 to Spear (“Spear”).

In the Answer, the Examiner has withdrawn the 8th rejection listed above, and the rejection of claim 51 in view of Ito. (Answer, p. 3). Accordingly, Appellants hereby request review of the remaining grounds of rejection.

Argument

(1) Claims 55 and 58 comply with 35 U.S.C. § 112, second paragraph:

Claim 55:

The Answer maintains that “claim 55 contracts [contradicts?] claim 49 from which it depends. It is unclear as to how pores that vary in diameter through a thickness of said substrate (claim 49) can be also ‘substantially uniform in size and shape’ (claim 55).”

(Answer, p. 4). Appellant has already clearly explained that claim 55 refers to the fact that the pores collectively are substantially uniform in size and shape, not that each pore is individually uniform within itself.

Applying a little logic, claim 49 recites “a plurality of pores formed through said substrate, said pores having a size that varies in diameter through a thickness of said substrate.” This statement must then be true of any claims that depend from claim 49. Claim 55 does and states “wherein said pores are substantially uniform in size and shape.”

Because claim 49 has already mandated that individual pores vary in diameter, claim 55 clearly does not mean that each pore does not vary in diameter, but is uniform within itself. There is no reason to take such a reading of claim 55 so as to contradict claim 49. Another, non-contradictory and equally clear reading exists for claim 55. Clearly, claim 55 means that the pores are substantially uniform from one pore to the next, i.e., “wherein said pores are substantially uniform in size and shape.” The only point to the Examiner’s argument is to create confusion where none need exist. For at least these reasons, the rejection of claim 55 under § 112 should not be sustained.

Claim 58:

Claim 58 recites:

An apparatus comprising:
a fuel cell configured for providing power, said fuel cell comprising:
a support substrate supporting a solid cathode material deposited on a first side of said substrate, a solid anode material deposited on a second side of said substrate and an electrolyte; and
a plurality of pores formed through said substrate, said pores having a size and shape formed in accordance with a pre-selected desired porosity.

The Answer maintains a rejection under 35 U.S.C. § 112, second paragraph, to the term ‘pre-selected desired’ porosity.” (Answer, p. 11).

However, the Answer now, for the first time, argues that “‘pre-selected desired porosity’ is a concept (pg 12, line 5 of Appeal Brief), and does not structurally define the porosity.” (Answer, p. 12). Appellant must respectfully submit that this is an argument regarding what patentable weight should be given the phrase “pre-selected desired porosity” and is clearly *not* an argument that the claim language is indefinite or otherwise improper under § 112, second paragraph.

Consequently, the nature of the Examiner’s objection is improperly framed as a rejection under §112, second paragraph. There is nothing indefinite about “pre-selected desired porosity.” Either the porosity was selected prior to the formation of the pores and formation of the pores controlled to satisfy that selected porosity or not. Again, there is nothing indefinite about claim 58, and there is no basis here for a rejection under § 112, second paragraph.

As given previously, the heart of the Examiner’s argument is as follows. “Examiner notes that there is no structural difference between an electrolyte with a porosity that was determined before or during or after the manufacture.” (Answer, p. 6). As Appellant has previously noted, this is clearly incorrect. If one of skill in the art selects a desired porosity

for an electrolyte *prior to manufacture* and adjusts the manufacturing variables to produce that desired porosity as taught by Appellant's specification, of course the resulting electrolyte will be structurally different than if the porosity were not pre-selected and controlled in this manner. Consequently, the claimed "pre-selected desired porosity" must be given patentable weight because it inescapably produces a structural difference in the resulting product than allowing the porosity to develop at random, without pre-selection.

In any event, the rejection of claim 58 under 35 U.S.C. § 112, second paragraph, should not be sustained.

(2) Claims 49, 50, 56, 58, 59, 65 and 66 are Patentable over Agruss:

Claim 49:

Claim 49 recites:

A fuel cell comprising:
a ceramic support substrate supporting a cathode, anode and electrolyte; and
a plurality of pores formed through said substrate, *said pores having a size that varies in diameter through a thickness of said substrate.*
(Emphasis added).

In contrast, to claim 49, Agruss does not teach or suggest a fuel cell comprising a porous substrate, "said pores having a size that varies in diameter through a thickness of said substrate." There is no teaching or suggestion in Agruss of this feature of claim 49.

Agruss teaches a "porous separator 14." The entire teachings of Agruss regarding this porous separator are as follows. "The porous separator 14 can be made of any suitable material which has the necessary porosity, inertness to the cell materials and high temperature stability which are required. Porous Alundum, for example, can be used." (Agruss, col. 2, lines 31-36). Clearly, there is no teaching or suggestion here of "pores having a size that varies in diameter through a thickness of said substrate."

In this regard, the Answer argues that Alundum is “[a] hard material composed of fused alumina, used as an abrasive and a refractory.” (Answer, p. 6). From this definition, the Answer speculates as follows. “The Examiner notes that pores formed of fused particles will not be uniform in shape. Due to the irregularity of the pores shapes and sizes, it is noted that the pores will vary in diameter through various cross sections of the Alundum substrate, thus varying in the thickness direction.” (Answer, p. 6).

Appellant notes that this is unsupported speculation. The cited definition of Alundum does not state that the material is made of alumina *particles* that are fused so as to create pores which vary in diameter within the meaning of Appellant’s claim. The Answer is clearly reading much into the cited definition of Alundum that is not there.

There is no evidence given on which to conclude, as the Examiner improperly does, that porous Alundum necessarily has pores that vary in diameter through the thickness of the substrate within the meaning of Appellant’s claims. Agruss clearly contains no such teaching.

It is incumbent upon the Examiner to identify where in the reference each element may be found. *Ex parte Levy*, 17 U.S.P.Q.2d 1461 (BPAI 1990). Consequently, when the Examiner fails to identify a claimed element, the Examiner has failed to establish a prima facie case of anticipation. Accordingly, the Answer is unable to cite to any teaching or suggestion in Agruss of the claimed fuel cell comprising a porous substrate, “said pores having a size that varies in diameter through a thickness of said substrate.”

"A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). See M.P.E.P. § 2131. For at least these reasons, this rejection of claim 49 should not be sustained.

Claim 58:

Claim 58 recites:

An apparatus comprising:
a fuel cell configured for providing power, said fuel cell comprising:
a support substrate supporting *a solid cathode material* deposited on a first side of said substrate, *a solid anode material* deposited on a second side of said substrate and an electrolyte; and
a plurality of pores formed through said substrate, said pores having a size and shape formed in accordance with a pre-selected desired porosity.
(Emphasis added).

In contrast, Agruss teaches “[a] liquid potassium rich solution of potassium and thallium in the upper chamber 10 forms a negative electrode while a thallium rich solution of liquid potassium and thallium in the lower chamber 12 forms a positive electrode.” (Agruss, col. 2, lines 25-30) (emphasis added).

According to the Answer, “potassium and thallium are solid materials because at temperature 173 C or below, thallium is solid (3:5-15). Thus, when the fuel cell is starting up from room temperature to its operating temperature, the fuel cell of Agruss would read on the instant claim limitations of ‘a solid cathode material’ and ‘a solid anode material.’” (Answer, p. 13). This is incorrect because when the Agruss fuel cell is first starting up and the potassium and thallium are solid, they are not an anode material and a cathode material, respectively. They do not become an anode and cathode material, respectively, until they liquefy as taught by Agruss. Consequently, at the point in time when the potassium and thallium taught by Agruss qualify as an anode and cathode material, they are liquid and no longer solid. Thus, the materials taught by Agruss can thus *never* be read on by claim 58 which calls for “*a solid cathode material* deposited on a first side of said substrate, *a solid anode material* deposited on a second side of said substrate.”

The Answer concedes that Agruss does not teach solid anode and cathode materials “at is operating temperature.” (Answer, p. 13). It is only at the operating temperature that the materials of Agruss can be considered or function as electrodes.

The Answer further argues that claim 58 “does not state that the electrode is solid at its operating temperature.” (Answer, p. 13). This is incorrect and evidences a lack of attention to the claim. Claim 58 recites “a solid *cathode* material” and “a solid *anode* material.” This inescapably dictates that the electrodes are solid *while functioning as cathode and electrode*, i.e., at the operating temperature of the fuel cell. In contrast, Agruss fails to teach or suggest the claimed porous substrate supporting a *solid cathode material* and a *solid anode material*.

Additionally, claim 58 recites “a plurality of pores formed through said substrate, said pores having a size and shape *formed in accordance with a pre-selected desired porosity*.” (Emphasis added). As noted herein, there is significant structural meaning attached to the recitation of pores having a size and shape formed in accordance with a pre-selected porosity. (See Sec. (1) above). In contrast, Agruss does not teach or suggest this subject matter.

"A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). See M.P.E.P. § 2131. For at least these reasons, the rejection of claims 58 and 59 should not be sustained.

(3) Claims 49, 50, 52, 55, 56, 58-61, 64, 70-72, 74, 75, 77-81, 83 and 84 are patentable over Ito:

Claim 49:

Claim 49 recites:

A fuel cell comprising:
a ceramic support substrate supporting a cathode, anode and electrolyte; and
a plurality of pores formed through said substrate, *said pores having a size that varies in diameter through a thickness of said substrate.*
(Emphasis added).

In contrast, Ito teaches the following.

In order to produce the solid electrolyte film according to the present invention, the plasma sprayed solid electrolyte film is formed on the substrate, and then the thus formed film is heated in a temperature range of 1,300.degree. to 1,700.degree. C.

That is, as shown in FIGS. 3 and 4, the microstructure of the conventional plasma sprayed solid electrolyte films having undergone no above heat treatment possess fine cracks or defects peculiar to the plasma sprayed films as well as several layers of laminar defects as shown in FIGS. 3 and 4. This causes a reduction in the electric conductivity and an increase in the gas leakage.

To the contrary, as shown in FIGS. 1 and 2, *the solid electrolyte film having undergone the above-mentioned heat treatment is free from microcracks and defects peculiar to the conventional plasma sprayed films, and possesses fewer laminar defects. Since the material moves to acute faces and corners of cleavages of cracks to make the shape of closed pores relatively spheroidal or near spheroidal, the solid electrolyte film has a microstructure near that of the solid electrolyte obtained by press molding powder to obtain a shaped body and then sintering the shaped body, and the composition of the film is homogeneous. As a result, the electric conductivity of the film is equivalent to that of the sintered body, and leakage of gas can be prevented.* (Ito, col. 4, lines 10-36) (emphasis added).

Thus, Ito does not teach or suggest the claimed fuel cell with a ceramic substrate having pores there through. To the contrary, Ito teaches a sintered or heat-treated film in which material flows to close cracks and defects and to *close pores* such that the “leakage of gas can be prevented.” Clearly, this teaches away from the claimed fuel cell comprising “a ceramic support substrate supporting a cathode, anode and electrolyte; and a plurality of pores

formed through said substrate, said pores having a size that varies in diameter through a thickness of said substrate.”

Without digesting the text of Ito, as cited above, the Answer concludes that “the irregular shapes depicted in the micrographs are in actuality ‘pores.’” (Answer, p. 13). There is no support, however, for this conclusion. To the contrary, as cited above, Ito teaches that the pores are closed during heat treatment. Thus, the Examiner is again trying to read teachings into Ito that simply are not there.

Clearly, there is no reasonable basis on the record for reading into Ito the subject matter of claim 49, as the Office Action attempts to do. "A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). See M.P.E.P. § 2131. For at least these reasons, this rejection of claim 49 should not be sustained.

Claim 51:

Claim 51 recites:

A fuel cell comprising:
a support substrate supporting a cathode, anode and electrolyte; and
a plurality of pores formed through said substrate,
wherein *said pores vary in diameter by tapering to a narrow point
between two openings, both openings being larger than said narrow point.*
(Emphasis added).

As noted above, the rejection of claim 51 in view of Ito was withdrawn. (Answer, p. 3). Consequently, claim 51 is considered in condition for allowance.

Claim 58:

Claim 58 recites:

An apparatus comprising:
a fuel cell configured for providing power, said fuel cell comprising:
a support substrate supporting a solid cathode material deposited on a first side of said substrate, a solid anode material deposited on a second side of said substrate and an electrolyte; and
a plurality of pores formed through said substrate, *said pores having a size and shape formed in accordance with a pre-selected desired porosity.*
(Emphasis added).

With regard to claim 58, the Answer now argues that “it is noted that the porosity has been pre-selected because the electrolyte is made as a porous material and has been predetermined by Ito that the porosity is less than 5% as stated in the Abstract of Ito.” (Answer, p. 13). In response, Appellant must point out the obvious: that measuring the porosity (of closed pores, by the way) after formation is not the same thing as pre-selecting a desired porosity, as claimed, and then forming the substrate to that specification.

Ito is absolutely devoid of any teaching or suggestion of the claimed apparatus comprising a support substrate and “a plurality of pores formed through said substrate, said pores having a size and shape formed in accordance with a pre-selected desired porosity.” “A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). See M.P.E.P. § 2131. For at least these reasons, this rejection of claim 58 should not be sustained.

(4) Claims 58, 60-62, 64 and 67 are patentable over Faita:

Claim 58:

Claim 58 recites:

An apparatus comprising:
a fuel cell configured for providing power, said fuel cell comprising:
a support substrate supporting a solid cathode material deposited on a first side of said substrate, a solid anode material deposited on a second side of said substrate and an electrolyte; and
a plurality of pores formed through said substrate, *said pores having a size and shape formed in accordance with a pre-selected desired porosity.*

(Emphasis added).

In contrast, Faita utterly fails to teach or suggest this subject matter. According to Faita, “the bipolar plate (1) is made of a metal plate which may have a flat surface in the area of contact with the collector (14). The peripheral frame area of the bipolar plate (1) is provided with holes (2) and optionally with distribution channels (3) for the inlet and outlet of the gasses.” (Faita, col. 5, lines 53-58). Thus, Faita teaches a bipolar plate at the outside of an electrochemical cell (See Fig. 1) with holes for admitting gases to the enclosed electrochemical cell. Consequently, the bipolar plate (1) of Faita to which the Action refers is clearly not “a support substrate supporting *a solid cathode material deposited on a first side of said substrate, a solid anode material deposited on a second side of said substrate* and an electrolyte,” as recited in claim 58. (Emphasis added).

In response, the Answer, argues that “the claim does not require the pores to be located inside the region of contact with the electrode.” (Answer, p. 14). This is problematic because, as noted above, the claim *does* state that the cathode material is “deposited on a first side of said [support] substrate” and the anode material is “deposited on a second side of said substrate.” The Answer appears to have entirely overlooked these aspects of claim 58, i.e., that the anode and cathode material are deposited on the support substrate. Clearly, there is

no cathode material deposited on a first side of the bipolar plate or frame taught by Faita.

There is no anode material deposited on a second side thereof.

Thus, Faita clearly fails to teach or suggest the subject matter of claim 58. “A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). See M.P.E.P. § 2131. Therefore, for at least the reasons explained here, the rejection based on Faita of claim 58 and its dependent claims should be reconsidered and withdrawn.

(5) Claim 76 is patentable over Ito and Hibino:

This rejection is respectfully traversed for at least the same reasons given above in favor of independent claim 58. Therefore, this rejection of claim 76 should not be sustained.

(6) Claim 73 is patentable over Ito and Doshi:

This rejection is respectfully traversed for at least the same reasons given above in favor of independent claim 49. Therefore, this rejection of claim 73 should not be sustained.

(7) Claim 82 is patentable over Ito and Doshi:

This rejection is respectfully traversed for at least the same reasons given above in favor of independent claim 58. Therefore, this rejection of claim 82 should not be sustained.

(8) Claims 49, 51-53, 55 and 57 are patentable over Faita and Spear:

This rejection was withdrawn by the Answer. (Answer, p. 3).

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Rejection of August 21, 2008 is respectfully requested.

Respectfully submitted,

DATE: August 10, 2009

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